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Revision of the Nearctic Moth Genus ABAGROTIS Smith with Descriptions of New Species (Lepidoptera:Noctuidae), Part 4

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REVISION OF THE NEARCTIC MOTH GENUS ABAGROTIS SMITH WITH DESCRIPTIONS OF NEW SPECIES

(Lepidoptera: Noctuidae)

PART IV: THE ALTERNATA GROUP, WITH THE DESCRIPTION OF A NEW SPECIES FROM SOUTHERN CALIFORNIA; THE DISCOIDALIS GROUP; THE APPOSITA GROUP.

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A. alternata Group

Diagnosis - Antennae basally ciliate, apically setose-ciliate, ciliations apically subequal to length of flagellomeres; palpi exterolaterally tan to blackish; thorax with divided collar, may be transversely banded, or unicolorous; primaries tan to dark brown, or brick red; aedeagus of male genitalia possessing a single cornutus, two cornuti, or a single cornutus plus a spined sclerotized band; valves slightly thickened, may be chunky (as in fig. 62); ampulae prominent; uncus not abruptly pointed, but gradually so; female genitalia with ovipositor lobes truncate; ductus bursae not heavily sclerotized, or very heavily sclerotized; bursa copulatrix with one or two signae; greatest expanse of forewing varies from 13 mm to 19 mm.

Included species - *A. alternata* (Grote), *turbulenta* McDunnough, *crumbi crumbi* Franclemont, *crumbi benjamini* Franclemont, *variata* (Grote), *scopeops* (Dyar), *tecatensis* Buckett, new species.

Distribution - Members of this group occur over all the United States northward into Canada.

Key to species of the *alternata* group by use of combined characters

1. Palpi exterolaterally tan to brownish, not blackish; aedeagus with vesical sac possessing a single cornutus plus a sclerotized band (as in figs. 99, 100); uncus nearly lanceolate. 2
   Palpi exterolaterally blackish; aedeagus possessing a single, or two cornuti on vesical sac, lacking spined sclerotized band; uncus blunt, may be truncate. 3

2. Large moths, greatest expanse of forewing 16 mm to 19 mm; subterminal line very irregular (as in figs. 143, 194); male genitalia with valves possessing strong preapical tooth; female genitalia with ductus bursae heavily sclerotized; ovipositor lobes with elongate, stout setae (as in fig. 132); bursa copulatrix generally with two signae. . . . . *alternata* (Grote)

   Medium sized moths, greatest expanse of forewing 14 mm to 16 mm; subterminal line even, or at least not as irregular as in preceding (as in figs. 195, 196, 197); valves appearing stout, lacking preapical tooth; female genitalia with ductus bursae weakly sclerotized, possessing accessory sac; ovipositor lobes possessing short, weak setae; bursa copulatrix with a single signa. . . . . *turbulenta* McDunnough

3. Ground color of primaries brick red, may be straw colored costally, to bone brown, elongated; terminal area irrorated with silvery-gray; transverse anterior and transverse posterior lines represented costally by prominent black dashes; ventral surfaces of primaries fuscous, with prominent glossy appearance; female genitalia with bursa copulatrix possessing two signae; ductus bursae not heavily sclerotized. 4

   Ground color of primaries tan to dark brown, if brick red, then subterminal line irregular and wingshape not elongate (as are moth in figs. 203-206); terminal area weakly or strongly irrorated with silvery-gray; ventral surface of wings fuscous, lacking prominent glossy appearance; female genitalia with bursa copulatrix possessing a single signa; ductus bursae heavily sclerotized, or not. 5

4. Ground color of primaries varying from brick red to red-brown; terminal area evenly irrorated with silvery-gray; of western distribution. . . . . *crumbi crumbi* Franclemont

   Ground color of primaries bone brown; terminal area irrorated costally with silvery-gray, fading inner marginally; occurring in northeastern United States and adjacent Canada. . . . . *crumbi benjamini* Franclemont

5. Reniform mark and orbicular spot prominently represented in comparison to ordinary cross lines; greatest expanse of forewing 14 mm to 16 mm; male genitalia with sacculus narrow basally (as in figs. 65, 66); female genitalia with ductus bursae weakly sclerotized. 6

   Reniform mark and orbicular spot weakly represented in comparison to ordinary cross lines; greatest expanse of forewing 17 mm to 18 mm; male genitalia with sacculus broad basally (as in fig. 64); female genitalia with ductus bursae heavily sclerotized; tapering from genital opening to junction of bursa copulatrix, the latter portion narrowest (as in fig. 137). . . . . *variata* (Grote)

6. Ground color of primaries red-brown to dark brown; terminal area narrow (as in figs. 206-208); irrorated evenly with silvery-gray for entire length; maculation strong, contrasting; male genitalia with

juxta as wide as long; aedeagus possessing extensively sclerotized spined band (as in fig. 105); female genitalia with setae of ovipositor lobes somewhat thickened. . . . . .*scopeops* (Dyar)

Ground color of primaries tan to ochreous-brown; terminal area wide in comparison to preceding (as in figs. 209, 212), weakly irrorated with silvery-gray, this color fading out inner marginally; maculation not prominent, may be obscured; male genitalia with juxta twice as long as wide; aedeagus possessing weakly sclerotized spined band (as in fig. 105); female genitalia setae of ovipositor lobes weak. . . . . .*tecatensis* J.S. Buckett, new species

Abagrotis alternata (Grote)
(figs. 14, 61, 99, 132, 193, 194)

Noctua alternata Grote, 1864, Proc. Entomol. Soc. Philadelphia 3:526, pl. 5, fig. 8 (in color), lectotype female "Grote"; "Type No. 7625 *Noctua alternata,* A. R. Grote" type deposited (ANSP), by present designation; Forbes, 1954, Mem. Cornell Agr. Exp. Sta. No. 239, pp. 70-71, figs. 84, 90.

Agrotis alternata, Grote, 1868, Trans. American Entomol. Soc. 2:309; 1874, Canad. Ent. 6:214; 1878, Canad. Ent. 10:235; 1883, Proc. Amer. Philos. Soc. 21:155; 1895, Abhandl. Naturwissenschaftlichen Verein, Bremen 14:58.

Cerastis alternata, Grote, 1874, Canad. Ent. 6:15.

Rhynchagrotis alternata, J. Smith, 1890, Bull. U.S. Nat. Mus., No. 38, pp. 16, 17, 23-24; 1893, Bull. U.S. Nat. Mus., No. 44, p. 53; Dyar, 1899, Proc. Entomol. Soc. Washington 4:316; 1903 (1902), Bull. U.S. Nat. Mus., No. 52, p. 129; Holland, 1903, the Moth Book, p. 179 (nec. 178 of auct.), pl. 21, fig. 20; J. Smith, 1908, Canad. Ent. 40 (8):286; Barnes and McDunnough, 1917, Contrib. Lep. North Amer. p. 48.

Triphaena alternata, Hampson, 1903, Cat. Phalaenidae Brit. Mus. 4:625, 637-638, pl. 77, fig. 12.

Lampra alternata, Benjamin, 1921, Bull. So. California Acad. Sci. 20 (3):83, 105-106; Draudt, in Seitz, 1923, the Macrolepidoptera of the World 7:82; Crumb, 1932, Bull. Brooklyn Entomol. Soc. 27(2):90-91.

Abagrotis alternata, McDunnough, 1938, Mem. So. California Acad. Sci. 1:67; Crumb, 1956, U.S.D.A., Tech. Bull. 1135, pp. 114, 115; Prentice, *et. al.,* 1962, Canadian Dept. Forestry, Bull. 128, p. 119; Kimball, 1965, Arthropods Florida (Lepidoptera) 1:87.

Diagnosis - Male: Ground color of primaries olive to dark brown. Head with vertex clothed in brown-tipped, light brown simple hairs; palpi basally clothed in light tan, rose elongate flattened hairs; first segment exterolaterally in admixture of rose, dark brown spatulate scales;

second segment exterolaterally clothed in rose scales basally, an irroration of dark brown scales medially, apically tan, ventrally clothed in elongate rose, dark brown flattened hairs; antennae with scape encircled in tan spatulate scales; flagellar segments dorsally clothed in black scales, ventrally setose-ciliate, setations becoming longer apically; compound eyes laterally bordered with black simple hairs, hairs extending toward wing base, rose apically. Thorax with divided collar of light brown elongate scales, irrorated with dark brown, apically tan-tipped; disc, tegulae concolorous brown; posterior tufts tricolor, minute, basally brown, preapically black, apically light brown; posteriorly clothed in fuscous hairs; ventrally light brown, rose tinted simple hairs; legs with femora clothed in light brown, rose tinted simple scales, irrorated with dark brown; tibiae dorsally clothed in rose tinted simple scales, laterally clothed in tan to fawn brown elongate simple hairs; tarsi dark, unicolorous, each tarsomere with, at best, only a suggestion of tan apical annulus; primaries dorsally of ground color, maculation generally distinct; basal half line geminate, dark brown, filled with brown; transverse anterior line irregular, colored as in basal half line; orbicular spot oblong, not round, outlined in ochreous, filled with dark brown; reniform mark huge, erect, rectangular, slightly constricted medially, outlined in ochreous, centrally filled with dark brown rose tinted scales; transverse posterior line geminate, dark brown, represented by dots on veins, filled with ground color; subterminal line very irregular, defined by contrast between subterminal area of ground color and terminal area; terminal area irrorated with ochreous scales, much lighter than other areas of surface; terminal line dark brown, represented by lunules on veins; fringes bicolor, basally ochreous, terminally dark brown; ventral surface with or without light ochreous costal area; transverse posterior line defined costally in black; subterminal area diagonally to terminal area on M_3 ochreous; inner marginal area irrorated with ochreous; terminal line as in dorsal surface; fringes with wider band of ochreous than on dorsal surface, otherwise same; secondaries dorsally dark fuscous, discal dot dark brown, hardly discernible; veins outlined in dark brown; fringes tricolor, lightest basally, preapically, dark fuscous; costal area irrorated with ochreous, pink tinted scales; discal dot prominent, black; exterior line prominent, dark brown; fringes bicolor, basally ochreous, apically of fuscous, pink tinted scales. Abdomen dorsally of ground color; ventrally of rose tinted scales. Greatest expanse of forewing 16 mm to 19 mm. Genitalia as in figs. 61, 99.

Female - As in male, except abdomen dorsally may possess rose tinted elongate terminal hairs. Greatest expanse of forewing 17 mm to 19 mm. Genitalia as in fig. 132.

Material studied - 98 males, 162 females, June through October. CANADA. *Alberta:* Lethbridge. *Manitoba:* Cartwright; "Manitoba." *Nova Scotia:* Armdale; Digby. *Ontario:* Ancaster; Hymers; Kingburn; *Ottawa:* Sudbury; Teeswater. *Quebec:* Lea Mandor; Meach Lake. UNI-

TED STATES. *Colorado:* Denver; Elpaso; Garfield; Larimer. *Connecticut:* New Haven; Windham. *Florida. Illinois:* Chicago; Dupage. *Indiana:* Tippecanoe. *Kansas:* Douglas; "Kansas." *Maine:* Cumberland; Franklin. *Maryland. Massachusetts:* Barnstable; Essex; Middlesex; Norfolk. *Mississippi. Missouri:* Cole; "Missouri." *New Hampshire:* Hillsboro; Rockingham. *New Jersey:* Bergen; Essex; Ocean; Passaic; Sommerset; Sussex; Union. *New Mexico:* Grant; "New Mexico." *New York:* Brooklyn; Green; Orange; Rockland; Suffolk; Washington; Wayne. *Ohio:* Franklin. *Pennsylvania:* Lackawanna; Northampton; Wayne. *South Dakota:* Brookings; "South Dakota." *Tennessee:* Knox; "Tennessee." *Utah:* Tooele; Utah. *Virginia:* Fairfax. *Wisconsin:* Door.

Recognition characters - *A. alternata* can be distinguished from another large species, *variata*, by the following features: 1) more prominent orbicular spot and reniform mark; 2) palpi exterolaterally tan to brownish, not blackish; and 3) by possession of a strong preapical tooth in the male genitalia. *A. alternata* is olivaceous to dark brown and does not exhibit the degree of variation found in *variata*. From *turbulenta,* its closest superficial relative, *alternata* may be distinguished by 1) its larger size, 2) its very irregularly coursed subterminal line, 3) as in "3" above, 4) ductus bursae of female heavily sclerotized, 5) ovipositor lobes possessing elongate, stout setae, and 6) bursa copulatrix generally with two prominent signae.

Immature stages - The mature larvae are 32 mm to 35 mm in length; 5 mm broad at middle, with abdominal segments of nearly equal width throughout; general ground color infuscated brown; skin smooth; head 2.6 mm to 3.0 mm broad (*teste* Crumb). This species feeds on buds and foliage of apple, hickory, oak, walnut, cherry and strawberry. Larvae probably feed on a number of additional plant species, however Forbes (1954) believed that *alternata* was "perhaps confused with the preceding." By "preceding" he was referring to *A. barnesi.* If Forbes supposition is correct, then perhaps some of the hostplants listed for *alternata* may be incorrectly assigned.

Distribution - This species is principally of northern and eastern distribution in North America. It occurs south into Florida (Kimball, 1965), westward into Arizona (Crumb, 1932), thence northward into Canada (see distribution map, fig. 14). *A. alternata* is most abundant in temperate deciduous and coniferous forests.

Abagrotis turbulenta McDunnough

(figs. 16, 62, 100, 133, 195-197)

Abagrotis turbulenta McDunnough, 1927, Canad. Ent. 59:198, holotype male Seton Lake, British Columbia, Canada, June 8 (J. McDunnough) type No. 2556 (CNC); 1938. Mem. So. California Acad. Sci. 1:67; Llewellyn-Jones, 1951, Entomol. Soc. Brit. Columbia, Occasional Paper No. 1, p. 53.

Diagnosis - Ground color of primaries a rich chocolate brown, basal, transverse anterior and terminal areas washed with a bluish-white irroration. Head with frons clothed in tan, scales washed in white; vertex with scalation darker brown than that on frons; palpi with basal segment clothed in rose colored flattened hairs; second segment clothed exterolaterally in brownish scalation plus elongate rose colored simple hairs, apically clothed in light tan scales; third segment clothed in darker scalation than apical portion of preceding segment; antennae dorsally clothed in light tan, ventrally finely ciliate, apically setose. Thorax with divided collar porrect, clothed in white and fawn brown spatulate scales; disc clothed in fawn brown simple hair; ventrally clothed in rose and white simple hairs; all femora clothed in light tan, irrorated with rose scalation; tibiae dorsally with band of elongate rose and tan scales and hairs, hairs becoming longest on metatibiae, laterally and ventrally clothed in rose scales, irrorated with white; tarsi clothed in rose and tan, a faint white annulus apically on each tarsomere; primaries with basal half line brown, geminate centrally filled with a bluish-white hue; inner marginal portion of basal area confluent with transverse anterior area, with a bluish-white hue; transverse anterior line geminate, brown, centrally filled with a bluish-white hue; median area of ground color; orbicular spot large, outlined in light tan, centrally filled with a darker brown than ground color; reniform mark erect, slightly constricted medially, colored as in orbicular spot; transverse posterior line outwardly oblique, geminate, dark brown, centrally filled with ground color; subterminal space of ground color, a series of darker spots on veins; subterminal line basally a dark brown, apically light tan, broader on costa; terminal space bluish-white; terminal line dark brown, indented between veins; fringes of ground color; ventral surface with light colored costal band from transverse anterior line to subterminal line; transverse posterior line represented on costa by dark band; inner marginal portion bluish-white; terminal area light tan, veins outlined in dark brown; remainder of wing dark brown; secondaries dorsally deep fuscous, lightest basally; discal dot hardly discernible; fringes tricolor, basally tan, medially dark brown, terminally light tan; ventral surface brown, costally irrorated with an admixture of rose and tan scales; discal dot dark brown, prominent; exterior line dark brown, represented in costal band, thence hardly discernible; remainder of wing dark brown, irrorated with tan; fringes as in dorsal surface. Abdomen dorsally lighter brown than thorax, terminal simple hairs tan to rose colored; ventral surface clothed in tan scales and hairs. Greatest expanse of forewing 14 mm to 16 mm. Genitalia as in figs. 62, 100.

Female - Ground color of primaries bone brown which may be irrorated with bluish-white; markings on ventral surfaces of wings less defined than in male; antennae as in male; remainder as in male. Greatest expanse of forewing 14 mm to 16 mm. Genitalia as in fig. 133.

Material studied - 8 males, 15 females, June through September. CANADA. *Alberta:* Manyberries. *British Columbia:* Summerland. *Vancouver Island.* UNITED STATES. *Arizona:* Coconino; Gila. *Colorado:* Delta; El Paso; Garfield; Pitkin; Routt. *Nevada:* Elko. *New Mexico. Utah:* San Juan; Utah. *Washington.*

Recognition characters - *A. turbulenta* is a medium sized species, and can be superficially confused with both *alternata* and *placida.* From *placida, turbulenta* may be separated by: 1) primaries dorsally with broader terminal area; 2) secondaries ventrally with strong dark exterior shade; 3) male genitalia possessing greatly broadened valves basally; and 4) female with a single signa on bursa copulatrix. *A. turbulenta* may be separated from *alternata* by: 1) smaller expanse of forewing (14 mm to 16 mm); 2) subterminal line with less irregular course; 3) genitalia in male lacking preapical tooth of valves; and 4) character "4" above.

The Canadian specimens possess more contrastingly marked primaries than specimens collected more to the south.

Distribution - Not enough is known about this species to accurately delimit its range. *A. turbulenta* was originally described from British Columbia and since the time of the original description has been collected in the United States. This species occurs in the Rocky Mountain range of the central United States, westward into isolated mountain ranges in Nevada, and southward into Arizona (see distribution map, fig. 16). In the U.S., specimens have been collected, for the most part, at medium to higher elevations (6,000 ft. to over 8,000 ft.).

Abagrotis crumbi crumbi Franclemont
(figs. 17, 63, 101, 134, 135, 198-201)

Abagrotis crumbi Franclemont, 1955, Bull. Brooklyn Entomol. Soc. 50 (2):44-46, figs. 1, 2, and 3, holotype male, White Swan, Washington, June 5, 1933 (S.E. Crumb), type No. 54946 (USNM). Crumb, 1932, (as *"placida"*), Bull. Brooklyn Entomol. Soc., 27(2):89-90; 1956, U.S.D.A. Tech. Bull. 1135, pp. 115, 121.

Diagnosis - Male: Ground color of primaries brick red to red brown. Head with vertex and frons clothed in brown, brick red, white-tipped flattened hairs; palpi with basal segment exterolaterally clothed in sooty to blackish simple hairs and spatulate scales, ventrally clothed in elongate white-tipped tan and brown flattened hairs, apically clothed in cream-colored simple hairs and spatulate scales; third segment stubby, colored as in apical part of second segment; antennae with scape clothed dorsally as in frons, ventrally and laterally clothed in cream-colored spatulate scales; flagellar segments clothed dorsally in black scales, ventrally finely ciliate basally, setose-ciliate apically. Thorax with divided collar composed of tricolor flattened hairs, basally and

medially brick red, preapically brown, apically white-tipped; disc and tegulae concolorous, brick red with scattered bicolorous white-tipped brown spatulate hairs; ventrally clothed in fine tricolored hairs, tan basally, preapically blackish, white-tipped; legs clothed in admixture of brown and white scales, hairs; tarsi not banded; primaries dorsally from base to subterminal line brick red to red brown, may have purplish cast; costally lighter colored than inner marginally in many instances; basal line when discernible, geminate, dark brown filled with ground color, costally a black dash; transverse anterior line geminate, dark brown filled with ground color, represented costally by black dash; orbicular spot outlined in ochreous, filled with ground color; reniform mark colored as in orbicular spot, may or may not be constricted medially; transverse posterior line colored as in transverse anterior line, but may have irroration of gray scalation inner marginally; subterminal line irregular in course, represented by contrast between ground color and silvery-gray terminal area; terminal area may also be irrorated with black; terminal line represented by black lunules between veins; fringes faintly tricolor, basally ochreous, medially fuscous, apically lighter; ventral surface with decided silky, or glossy appearance; costally straw-colored to olive, reniform mark faintly present in black; transverse posterior line indicated by black costal dash, thence fading inner marginally; terminal area irrorated with gray, but not as strongly as on dorsal surface; fringes as in dorsal surface; remainder of wing fuscous; secondaries dorsally fuscous, lightest basally; veins outlined in dark brown; discal dot present in black, faint; fringes long, tricolor, basally ochreous, medially dark brown, apically whitish; ventral surface fuscous with glossy appearance as in primaries; costally irrorated with gray scalation; exterior line present as black band; discal dot faint, black; veins outlined in dark brown; fringes as in dorsal surface. Abdomen dorsally fuscous, terminally with elongate straw-colored simple hairs; ventrally clothed in light tan. Greatest expanse of forewing 14 mm to 16 mm. Genitalia as in figs. 63, 101.

Female - As in male except ground color of primaries lighter in general; scape clothed dorsally in ground color; collar unicolorous, of ground color. Greatest expanse of forewing 13 mm to 16 mm. Genitalia as in figs. 134, 135.

Material studied - 38 males, 62 females, May through September. CANADA. *Alberta:* Manyberries. *British Columbia:* Kamloops; Keremeos; Lillooet; Oliver; Salmon Arm. UNITED STATES. *Arizona:* Coconino; Yavapai. *California:* Alpine; El Dorado; Inyo; Lassen; Mono; Nevada; Plumas; Toulumne. *Colorado:* Delta; El Paso; Garfield; Huerfano; Larimer. *Nevada:* Douglas; Washoe. *New Mexico:* McKinley; Sandoval. *Oregon:* Deschutes; Umatilla. *Utah:* Jaub; Utah. *Washington:* Chelan; Kittitas; Okanogan; Yakima.

Variation - This species varies in size, shape and ground color of the primaries. The primaries may be elongate, or less so and appear somewhat trigonate; the ground color can vary from reddish-tan, brick red, bone brown, to brown, or purplish; they may appear transversely banded (as in fig. 201); or the costal part may be light in comparison to the inner marginal part; or they might be unicolorous.

Recognition characters - *A. crumbi crumbi* may be confused with subspecies *benjamini, placida,* and *nefascia.* From *benjamini* nominate *crumbi* may be separated by: 1) the variable color of the primaries and brighter terminal area; and 2) a more western distribution. *A. crumbi* can be separated from the banded form of *placida* by: 1) the presence of red scalation in ground color of the primaries; 2) the more contrasting silvery-gray terminal area; and 3) in the male genitalia the broader valves (basally), and by lack of the vesical sclerotized band of the aedeagus. From reddish-brown specimens of *nefascia, crumbi* may be distinguished by: 1) a smaller size; 2) the more elongate wings; 3) more contrasting silvery-gray terminal area of the primaries; and 4) in the male terminalia by lack of the preapical tooth of valves.

Immature stages - This species was first discovered in Washington by S.E. Crumb, and reared from larvae collected on serviceberry (*Amelanchier* sp.) and wild currant (*Ribes aureum* Pursh.). Crumb (1932) also gives apple, cottonwood, hawthorne, grape, greasewood and poplar as larval foodplants of this species. The mature larva has a general ground color of brownish gray to black; the skin is smooth; the head is 2.3 mm to 2.4 mm broad; the body about 30 mm long and 4.5 mm broad medially (Crumb, 1956).

Distribution - This species is widely distributed occurring from California eastward into New Mexico, thence northward into Canada, and again eastward into New York where it blends into *crumbi benjamini.* This species probably represents a very recent evolutionary species group in itself, and it is doubtful whether all of the specimens included under this name are, in reality, conspecific. Further work is needed on the biology of this species to better ascertain the true intraspecific relationships between the widespread diverse populations.

Abagrotis crumbi benjamini Franclemont
(figs. 17, 202)

Abagrotis crumbi benjamini Franclemont, 1955, Bull. Brooklyn Entomol. Soc. 50(2):46, lectotype male, East New York, New York, July 17, 1900 (A.C. Weeks), male genitalia on slide No. 1203 F.H. Benjamin, type No. 54947 (USNM), by present designation.

Diagnosis - *Male:* As described for nominate *crumbi,* but ground color or primaries not as variable, bone brown, maculation not as strik-

ing; terminal area grayish, but not as contrasting with ground color as in nominate *crumbi;* secondaries lighter than in nominate *crumbi;* ventral surface of wings brown, lighter costally. Genitalia of male larger than in nominate *crumbi.*

Female: As described for male. Genitalia with ductus bursae more heavily sclerotized than in nominate *crumbi* (teste Franclemont, 1955). Female genitalia of this subspecies not seen by author.

Material studied - 7 males, 4 females, July through August. UNITED STATES. *Connecticut:* New Haven. *Massachusetts:* Barnstable. *New York:* Brooklyn; East New York.

Recognition characters - Distinguishing characters similar to *crumbi crumbi,* but *benjamini* can be separated from nominate *crumbi* by the following: 1) more constant ground color of primaries, which is bone brown; 2) less contrasting terminal area of primaries; 3) duller maculation; and 4) more eastern distribution.

Distribution - This species is only known from the extreme northeastern United States, and its infrequent occurrence in collections would indicate a restricted distribution. The localities where *benjamini* has been collected have been rather extensively collected in the past, but yet few specimens are known.

Abagrotis variata (Grote)

(figs. 13, 64, 102, 103, 104, 203-206)

Agrotis variata Grote, 1876, Bull. Buffalo Soc. Natur. Sci. 3:83, pl. 4, fig. 12, type female (?), exact location unknown; 1882, New List, p. 24 (not seen); 1883, Proc. American Philos. Soc. 21:144, 155; 1895, Abhandl. Naturwissenschaftlichen Verein, Bremen 14:58.

Amathes phyllophora (= *variata* and *varix,* in part), Butler, 1889, Trans. Entomol. Soc. London, p. 382.

Rhynchagrotis variata, J. Smith, 1890, Bull. U.S. Nat. Mus. No. 38, pp. 17, 22, 24, 25; 1893, Bull. U.S. Nat. Mus., No. 44, p. 53; Dyar, 1903 (1902), Bull. U.S. Nat. Mus., No. 52, p. 129; J. Smith, 1908, Canad. Ent. 40(7):222, 226-27; 1908, Canad. Ent. 40(8):286; Barnes and McDunnough, 1917, Check list Lepidoptera Boreal Amer., p. 48.

Triphaena variata, Hampson, 1903, Cat. Lepidoptera Phalaenidae Brit. Mus., 4:624, 637, pl. 77, fig. 11.

Lampra variata, Benjamin, 1921, Bull. So. California Acad. Sci. 20(3): 83, 101-103; Draudt, in Seitz, 1923, Macrolepidoptera of the World 7:82, pl. 12 (g and h), figs. 6 and 1 respectively.

Abagrotis variata, McDunnough, 1938, Mem. So. California Acad. Sci. 1:67; Llewellyn-Jones, 1951, Entomol. Soc. Brit. Columbia, Occasional Paper No. 1, p. 54; Crumb, 1956, U.S.D.A., Tech. Bull. No. 1135, pp. 114, 120.

Agrotis varix Grote, 1876, Bull. Buffalo Soc. Natur. Sci. 3:83; type female, exact location unknown.

Agrotis orbis Grote, 1876, Bull. Buffalo Soc. Natur. Sci. 3:83, type female, exact location unknown; 1878, Bull. U.S. Geo. Sur. Terr. 4:124; 1883, Proc. Amer. Philos. Soc. 21:144; 1891, Canad. Ent. 23 (7):150.

Rhynchagrotis orbitis Strand, 1916 (1915), Archiv. für Naturgeschichte 81, Abt. A Heft 12:147.

Diagnosis - Male: Ground color of primaries variable, light brown, brick red to olive, dark brown. Head with vertex clothed in tan simple hairs; palpi basally with elongate tan simple hairs; second segment exterolaterally with admixture of black and brown simple scales, apically tan; third segment tan; antennae with scape clothed in tan scales; flagellum dorsobasally clothed in tan scales, remaining flagellomeres dorsally clothed in black; ventrally finely ciliate, apically setose-ciliate; compound eyes laterally with dark brown hairs extending towards wing base. Thorax with divided collar light brown; anterior tuft of tan simple hairs; tegulae clothed in brown scales, irrorated with black flecks; posterior tufts bicolor, basally dark brown, apically tan; posteriorly clothed in tan simple hairs; ventral surface clothed in dark brown, tan-tipped simple hairs; legs with femora clothed in chocolate brown; tibiae exterolaterally clothed in tan flattened hairs; tarsi black, each tarsomere with tan apical annulus; primaries of ground color; ordinary cross lines prominent, in most cases, basal half line geminate, irrorated with white scales, giving appearance of being olive, centrally filled with ground color; transverse anterior line represented costally by black wedge, thence wavy, light olive, geminate, centrally filled with ground color; orbicular spot faint, if median area washed with white scalation then orbicular spot of ground color, otherwise hardly discernible; reniform mark faint, outlined in light olive, centrally filled with ground color; transverse posterior line colored as in transverse anterior line; subterminal area as ground color, may have veins outlined in light olive; subterminal line whitish, thin from costa to R_4 then basally ochreous, apically dark brown, if different, then ochreous, single; terminal area light blue-gray; terminal line scalloped, dark brown, continuous; fringes tricolor, basally dark brown, medially whitish, apically fuscous; ventral surface with costal area tan from base to past transverse posterior line; transverse posterior line represented costally in black; terminal area blue-gray; terminal line and fringes as in dorsal surface; inner marginal area whitish; remainder of surface fuscous; secondaries fuscous, lightest basally; discal dot dark brown, faint; veins outlined in dark brown; fringes tricolor, basally ochreous, medially dark brown, apically white; ventral surface fuscous, heavily irrorated with tan, darker preapically; discal dot present, dark brown; exterior line dark brown, faint. Abdomen dorsally of ground color; ventral surface of tan scales. Greatest expanse of forewing 17 mm to 19 mm. Genitalia as in figs. 64, 102-104.

Female - Maculation generally similar to that of male, may appear more faded in some specimens; coloration more variable than in male, from tan to dark brown with brick red being more common; otherwise as in male. Greatest expanse of forewing 16 mm to 19 mm. Genitalia as in fig. 137.

Material studied - 264 males, 322 females, May into November. CANADA. *British Columbia:* Departure Bay; Funney Bay; Kaslo; Oliver; Robson; Summerland. UNITED STATES. *Arizona:* Cochise; Coconino; Mojave; Navajo; Santa Cruz; Yavapai. *California:* Alameda; Colusa; Contra Costa; El Dorado; Lake; Los Angeles; Mendocino; Modoc; Mono; Monterey; Napa; Nevada; Plumas; San Bernardino; Shasta; Siskiyou; Sonoma; Trinity; Yolo. *Colorado:* Garfield; La Plata; Larimer. *Idaho:* Shoshone. *Nevada:* Washoe. *New Mexico:* Lune; McKinley; Sandoval; San Miguel. *Oregon:* Grant; Lake; Marion. *Utah:* Beaver; Jaub; Utah. *Washington:* King; Okanogan; Pierce; Stevens; Walla Walla; Wallula: Whitman.

Variation - This species, as the name implies, exhibits extreme and unparalleled color variation. Maculation and ground color of the primaries varies from light tan, olive-tan, brick red, red-brown, brown, dark brown. Maculation may be entirely wanting, or may be prominent. The vesical sac of the aedeagus may possess one or two cornuti. Further studies of this species, particularly biological studies, may demonstrate the presence of more than a single species.

Recognition characters - *A. variata* is a rather distinct species, but may be confused with *alternata* and *scopeops*. From *alternata, variata* may be separated by: 1) the blackish palpi exterolaterally; 2) aedeagus of male with vesica possessing a single, or two cornuti on vesical sac, but lacking sclerotized band; and 3) lack of prominent preapical tooth of valves. From *scopeops, variata* may be separated by: 1) reniform mark and orbicular spot weakly represented in comparison to ordinary cross lines; 2) greatest expanse of forewing 17 mm to 18 mm; 3) male genitalia with sacculus broad basally; 4) female genitalia with ductus bursae heavily sclerotized (as in fig. 137).

Immature stages - The mature larva of this species was apparently first described by Crumb (1956) from numerous larvae collected in Washington. These larvae reached maturity in April and May and the moths emerged in June. Crumb (*op. cit.*) cites willow, alder, wild cherry, serviceberry (*Amelanchier*), and mullein (*Verbascum thapsus* L.) as larval foodplants. The mature larva has a general ground color of dark gray with a segmental series of pale V-shaped dorsal markings; smooth skin; head 2.8 mm to 3.1 mm broad; body about 35 mm long, and 5.5 mm broad medially; and abdominal segments of equal width throughout (Crumb, 1956). Attempts to induce oviposition of this species failed.

Distribution - This species is abundant in the Pacific Coast states, and extends eastward into the Rocky Mountain range. It ranges from British Columbia southward into Arizona and New Mexico.

Abagrotis scopeops (Dyar)
(figs. 15, 65, 105, 136, 207-209)

Rhynchagrotis scopeops Dyar, 1904, Canad. Ent. 36(2):31, lectotype female, Kaslo, British Columbia, collection Dr. H. G. Dyar, genitalia on slide No. 1801, E. L. Todd, type No. 7327, by present designation; J. Smith, 1908, Canad. Ent. 40(7):222, 227; Barnes and McDunnough, 1917, Check list Lepidoptera Boreal Amer. p. 48.

Lampra scopeops, Benjamin, 1921, Bull. So. California Acad. Sci. 20 (3):101, 104, pl. 2, fig. 14, pl. 6, figs. 54 (??), 55; Draudt, in Seitz, 1923, the Macrolepidoptera of the World 7:82.

Abagrotis scopeops, McDunnough, 1938, Mem. So. California Acad. Sci. 1:67; Llewellyn-Jones, 1951, Entomol. Soc. Brit. Columbia, Occasional Paper No. 1, p. 54.

Diagnosis - Female: Ground color of primaries brown to dark brown, maculation prominent. Head with frons evenly rounded, clothed in dark brown simple scales and hairs; palpi with second segment blackish exterolaterally, ventrally clothed in elongate black hairs, third segment stubby, ventrally clothed in pinkish hairs; antennae with scape and pedicel clothed in whitish and pinkish spatulate scales; flagellar segments dorsally clothed in black scales, ventrally ciliate, apically setose-ciliate. Thorax dorsally with divided collar of white and dark brown spatulate scales and simple hairs; tegulae clothed in pinkish and brownish hairs with intermingling of white-tipped spatulate scales; disc clothed in pinkish-rose and brown hairs; ventrally clothed in whitish and brownish hairs, anteriorly with intermingling of black hairs; legs with femur clothed dorsally in white and black scales, ventrally clothed in elongate pink tinted whitish hairs; tibiae clothed in rose colored hairs and scales; tarsi clothed dorsally with black and white scales, ventrally clothed in white scales; primaries with basal line geminate, dark brown for costal half of wing, thence hardly discernible; transverse anterior area confluent with inner marginal basal area, olivaceous; transverse anterior line marked costally by two black wedges, thence brown, geminate, outcurved between veins, centrally filled with olivaceous; median area of ground color; orbicular spot neatly defined in ochreous; reniform mark subquadrate, neatly defined in ochreous, filled with ground color, or occasionally filled with darker scales; transverse posterior line represented costally by a black wedge, thence an irregular olivaceous band with olivaceous rays on veins in subterminal area; subterminal area darker than ground color; subterminal line represented as a sharp contrast between subterminal area and silvery terminal area; terminal line of black lunules on veins; fringes dark brown; ventral surface of wing brown, glossy; secondaries dorsally dark brown, fringes lighter; dark brown discal dot present; suggestion of exterior line costally. Abdomen brown dorsally, becoming rosy posteriorly; ventrally brown with rose tint. Greatest expanse of forewing 15 mm to 16 mm. Female genitalia as in fig. 136.

Male - As in female except ground color of primaries generally darker. Greatest expanse of forewing 14 mm to 16 mm. Genitalia as in figs. 65, 105.

Material studied - 54 males, 115 females, June through October. CANADA. *British Columbia:* Creston; Duncans; Kaslo; Keremeos; Robson; Summerland. UNITED STATES. *California:* Alpine; Del Norte; El Dorado; Kern; Lake; Modoc; Mono; Placer; Plumas; Shasta; Siskiyou. *Idaho:* Shoshone; Blaine. *Nevada:* Douglas. *Oregon:* Benton; Jackson; Josephine; Malheur; Marion; Tillamook; Umatilla; Union; Wasco; Washington. *Washington:* Okanogan; Yakima.

Recognition characters - *A. scopeops* can be confused with both *variata* and *tecatensis,* the latter being its closest relative. From *variata, scopeops* can be separated by: 1) reniform mark and orbicular spot prominently represented in comparison to ordinary cross lines; 2) greatest expanse of forewing 14 mm to 16 mm; 3) male genitalia with valves basally narrow; and 4) female genitalia with ductus bursae weakly sclerotized. From *tecatensis, scopeops* can be separated by: 1) ground color of primaries red-brown to dark brown; 2) terminal area narrow (as in figs. 207-209), irrorated evenly with silvery-gray for entire distance; 3) male genitalia with juxta as wide as long; and 4) female genitalia with ovipositor lobes setae somewhat thickened.

Distribution - This species occurs in western North America, Kern County, California northward into British Columbia, and eastward into Idaho and Nevada. *A. scopeops* occurs at lower elevations in the coast ranges, and also occurs at higher elevations (5,000 ft. to 6,000 ft.) in the Sierra Nevada Mountains of California.

Abagrotis tecatensis Buckett, new species
(figs. 15, 66, 106, 138, 210-212)

Holotype female - Ground color of primaries tan to light brown. Head with vertex clothed in light tan and brown flattened hairs; frons clothed in brown flattened and simple hairs; palpi exterolaterally blackish; second segment ventrally with elongate black, brown hairs, apical part of segment clothed in short light brown hairs and scales; third segment short, stubby, clothed in light brown hairs, ventrally possessing elongate black, brown hairs, these hairs being of equal length of segment; antennae with scape and pedicel clothed in light brown scales; flagellar segments dorsally clothed in light brown scales, medially and apically clothed in black scales, ventrally basally ciliate, apically setose-ciliate. Thorax with divided collar composed of light brown spatulate scales and hairs; tegulae clothed in light brown hairs with scanty intermingling of white-tipped spatulate scales; disc of light brown hairs; posterior tuft tricolor, basally light brown, medially black, apically white; ventrally clothed in light brown hairs for most part, anteriorly clothed with intermingling of black and light brown hairs; legs

with femora clothed dorsally in light brown, rosy, and dark brown scales, ventrally clothed in light brownish, black-tipped elongate hairs; fore tibiae dorsally with two lateral portions of light brown hairs, central portion of rosy scales, ventrally of rose scales; mid tibiae clothed ventrally in rose colored scales, becoming dorsally clothed in light brown hairs; hind tibiae dorsally clothed in elongate light brown hairs, becoming ventrally clothed in rose scales; tarsi clothed in black scales, apically an annulus of light brown and rose scales; primaries with maculation suffused; basal line hardly discernible, lighter brown than ground color; transverse anterior line dentate, geminate with central part of lighter brown than ground color; black costal wedge present just dorsad of transverse anterior line, and another proximad of transverse posterior line; orbicular spot large, a ring of cream scales, centrally filled with ground color; reniform mark bilobed, making a neat "B" on right forewing; transverse posterior line lighter brown than ground color, broadly outcurved around reniform mark, thence straight to inner margin; subterminal line represented by contrast between darker brown subterminal area and dull silvery terminal area; terminal area with silvery shading fading inner marginally; terminal line represented by dark brown lunules on veins; ventral surface dark brown, glossy, a light cream band present along costal and inner margins; transverse posterior line represented as thin black rectangle in light cream area; secondaries fuscous brown; discal dot hardly discernible; fringes lighter brown than ground color; ventral surface lighter brown than same surface of primaries; darkest from exterior band to fringes; fringes light brown. Abdomen dorsally brown, becoming rosy posteriorly; ventrally clothed in rose colored hairs. Greatest expanse of forewing 16 mm. Genitalia as in fig. 138.

Male - As female, but ground color of primaries darker brown; legs lack rosy areas; maculation more contrasting. Genitalia as in figs. 66, 106.

Types - Holotype female, Tecate Peak, San Diego County, California, 21 July 1963 (B. Reed); deposited in the entomology type collection, University of California, Davis. Paratypes: 1 male (designated allotype) same data as for holotype; 11 males, 19 females, same data as for holotype; 1 male, Blue Jay, San Bernardino County, California, 10 July 1957. Paratypes deposited in the following institutions and collections: AMNH; B-B; CAS; Franclemont; LACM; USNM; UCB; UCD.

Variation - This species exhibits little variation, either in size or in coloration. The females have lighter colored primaries and the maculation is less discernible than in the males.

Recognition characters - *A. tecatensis* can be confused only with *scopeops,* but may be distinguished by: 1) ground color of primaries tan to ochreous brown, not dark brown; 2) terminal area wider (as in figs. 210-212), and weakly irrorated with silvery-gray, this color fad-

ing out inner marginally; 3) maculation less evident; 4) male genitalia with juxta twice as long as wide (as in fig. 66); and 5) female genitalia with ovipositor lobes setae weak.

Distribution - This species is known only from southern California (see distribution map, fig. 15), and probably ranges southward into Nearctic Mexico.

A. discoidalis Group

Diagnosis - Antennae of male setose to setose-ciliate, of female same, or may be more setose basally; palpi with second segment exterolaterally rose colored, or blackish; thorax with collar divided or not; primaries with cell dark brown or black, prominent, or not; secondaries fuscous to dark fuscous; tarsi distinctly banded, ungues interolaterally bifurcate; male genitalia with valves slightly swollen, rounded apically; aedeagus with small, or medium sized cornuti (as in figs. 107, 108); female genitalia with ductus bursae moderately sclerotized; bursa copulatrix possessing one or two signae; greatest expanse of forewing varies from 14 mm to 17 mm.

Included species - *A. discoidalis* (Grote), *pulchrata* (Blackmore).

Distribution - Great Basin areas of western North America, as well as the Sierra Nevada Mountains of California, the Cascade Mountains of Oregon, and the coastal mountain ranges from northern California northward into Canada (see distribution map, fig. 18).

Key to species of the *A. discoidalis* group by superficial characters.

1. Vestiture of the head and abdomen concolorous, light brown; thorax with disc fawn-brown; discal cell of primaries black, conspicuous; secondaries brown. . . . . .*discoidalis* (Grote)

   Vestiture of head, thorax and abdomen intermixed with lilac colored scales and hairs; dark color of discal cell obscured by maroon scales; reniform mark and orbicular spot deep orange; secondaries deep smoky brown. . . . . .*pulchrata* (Blackmore)

Key to species of the *A. discoidalis* group by male genitalia.

1. Vinculum narrow, 1.75 mm or less at widest point; juxta a simple sclerotized plate; aedeagus greater than 0.5 mm at its narrowest point, cornutus bulbed (as in fig. 107), lacking spined sclerotized band or any other armament. . . . . .*discoidalis* (Grote)

   Vinculum spreading broadly, 2.0 mm or greater at widest point; juxta more elaborate than in preceding (as in fig. 68); aedeagus with a single cornutus plus a spined sclerotized band on vesica; aedeagus less than 0.5 mm at narrowest point. . .*pulchrata* (Blackmore)

Key to species of the *A. discoidalis* group by female genitalia.

1. Ovipositor lobes squared off, truncate, or very slightly rounded, sparsely pubescent; ductus bursae swollen, internally possessing a huge irregularly shaped sclerotized plate; bursa copulatrix heavily striate, possessing two triangulate signae. . . . . .*discoidalis* (Grote)

   Ovipositor lobes evenly rounded off, never truncate, heavily pubescent; ductus bursae somewhat swollen, but lacking any sclerotized plate; bursa copulatrix striate, possessing a single triangulate signum. . . . . .*pulchrata* (Blackmore)

Abagrotis discoidalis (Grote)
(figs. 18, 67, 107, 139, 213-215)

Agrotis discoidalis Grote, 1876, Bull. Buffalo. Soc. Natur. Sci. 3:82, pl. 4, fig. 9, type female (BMNH), lectotype yet to be designated; 1883, Proc. Amer. Phil. Soc. 21:144 (list), 1895, Abhandl. Naturwissenschaftlichen Verein, Bremen 14:58.

Rhynchagrotis discoidalis, J. Smith, 1890, Bull. U.S. Nat. Mus., No. 38:29, 30, 36; 1893, Bull. U.S. Nat. Mus., No. 44:56; Dyar, 1903 (1902), Bull. U.S. Nat. Mus., No. 52:129; J. Smith, 1908, Canad. Ent. 40(7):222, 225; Barnes and McDunnough, 1917, Check list Lepidoptera Boreal Amer., p. 48.

Triphaena discoidalis, Hampson, 1903, Cat. Lepidoptera Phalaenidae Brit. Mus. 4:624, 636, pl. 77, fig. 9; Barnes and McDunnough, 1912, Contrib. Lepidoptera North Amer. 1(4):5, pl. 1, fig. 5.

Lampra discoidalis, Benjamin, 1921, Bull. So. California Acad. Sci. 20(3):82, 92-93, pl. 1, fig. 7, pl. 5, fig. 42; Draudt, in Seitz, 1923, the Macrolepidoptera of the World 7:81, pl. 12(g), fig. 1.

Abagrotis discoidalis, McDunnough, 1938, Mem. So. California Acad. Sci. 1:67; Crumb, 1956, U.S.D.A., Washington, D.C., Tech. Bull. 1135, pp. 114, 119.

Diagnosis - Male: General ground color olive, subterminal area lighter. Head with palpi exterolaterally black, second segment apically lighter, third segment stubby, light in coloration; frons clothed in bicolored flattened and simple hairs, light tan basally, black apically with a distinct purple sheen; vertex clothed as in frons; antennae with scape clothed in flattened black and tan hairs; flagellar segments clothed in black scales dorsally, scantily setose ventrally, setations becoming longer apically. Thorax dark in ground color; collar lighter than ground color, composed of white-tipped spatulate hairs, with a distinct purple sheen; tegulae composed of brown, white, black spatulate scales plus bicolored simple hairs, basally dark, apically tan; disc rust red, sunken below level of tegulae; venter clothed in light tan pubescence; legs with tibiae clothed dorsally in light tan simple hairs, laterally and ventrally clothed in black and white spatulate hairs; primaries with

ordinary cross lines prominent, or somewhat obscured; when prominent, basal half line geminate, black, centrally filled with light olive; transverse anterior line colored as in basal half line, with three outward scallops; cell black from transverse anterior line to just past reniform mark; median space of ground color; claviform faint, black, filled with light olive; orbicular spot light olive outlined, filled with ground color; reniform mark indistinct with both costal and inner marginal portion faded into ground color; transverse posterior line geminate, black, filled with light olive; subterminal area dark, contrasted with terminal area; subterminal line irregular, defined by dark subterminal area and light olive terminal area; terminal line represented by lunules on veins; fringes light brown; ventral surface brown, lighter costally; transverse posterior line represented by black dash on costa; terminal area contrasting with remainder of wing; terminal line and fringes as in dorsal surface; secondaries dorsally fuscous; discal dot faint; veins outlined in dark brown; fringes white apically; ventral surface lighter than dorsal surface; discal dot very faint; exterior line present in black; fringes lighter than remainder of wing. Abdomen basally dark, lighter apically; terminally with brown and light olive simple elongated hairs; ventrally light tan. Greatest expanse of forewing 14 mm to 16 mm. Genitalia as in figs. 67, 107.

Female - As in male except lighter in color; cell of primaries irrorated with brown. Greatest expanse of forewing 14 mm to 17 mm. Genitalia as in fig. 139.

Material studied - 110 males, 262 females, June through October. CANADA. *Alberta:* Manyberries. UNITED STATES. *Arizona:* Coconino. *California:* El Dorado; Fresno; Inyo; Lassen; Modoc; Mono; Nevada; Placer; Plumas; Sacramento; Shasta; Sierra; Tuolumne. *Colorado:* Montrose. *Idaho:* Owyhee. *Nevada:* Esmeralda; Washoe. *New Mexico:* McKinley. *Oregon:* Lake; Malheur. *Utah:* Jaub; Salt Lake; San Juan; Tooele; Utah. *Washington:* Yakima.

Recognition characters - This species is quite distinctive, but might be confused superficially with worn specimens of *pulchrata* (Blackmore), or with some of the forms of *Rhynchagrotis exsertistigma* Morrison. *A. discoidalis* may be distinguished from its close superficial counterpart, *pulchrata,* by: 1) its olive ground color of the primaries; 2) lack or brightly orange colored orbicular spot and reniform mark; and 3) lack of rose, or pink tinted scales and hairs of the thorax and abdomen.

Of the numerous reproductions of *discoidalis,* the colored illustration by Hampson (vol. 4, pl. 77, fig. 9) is the best. Available black and white photographs are either under or over-exposed (Grote, 1876; Barnes and McDunnough, 1912; Benjamin, 1921). Old specimens of *discoidalis* have a tendency to fade more than is true for most moths. They lose their olive cast, and may become chocolate brown.

Distribution - *A. discoidalis* is the most widely distributed of the two species in the group, with records from the whole of western North

America including southern California, Arizona, New Mexico and northward into Alberta and British Columbia, Canada. It occurs at higher elevations, and primarily in areas showing a Great Basin influence. Crumb (1956) cites greasewood, *Sarcobatus vermiculatus* (Hook), as the larval host plant for *discoidalis* in Washington, and this may prove to be the foodplant over most of its range, as the black greasewood is a wide ranging desert shrub occurring over much the same range as does *discoidalis*.

Abagrotis pulchrata (Blackmore)
(figs. 18, 68, 108, 140, 216, 217)

Lampra pulchrata Blackmore, 1925, Canad. Ent. 57(8):205, holotype male, Maple Bay, near Duncan, British Columbia, August 16, 1920 (CNC).

Abagrotis pulchrata, McDunnough, 1938, Mem. So. California Acad. Sci. 1:67; Llewellyn-Jones, 1951, Entomol. Soc. Brit. Columbia, Occasional Paper No. 1, p. 54.

Diagnosis - Male: Ground color of primaries bicolorous, apparently transversely banded, transverse anterior and terminal areas yellow-olive, while remainder of wing surface maroon in color. Head with palpi exterolaterally of dark, white and rose flattened hairs; third palpal segment stubby, basally dark, apically tan; frons and vertex clothed in light tan and darker flattened hairs; scape clothed in light tan scales, short, flagellum dorsally clothed in black scales, ventrally setose-ciliate. Thorax with collar of white, maroon, orange, rose, and brown spatulate scales, inner margin of red-orange spatulate scales; disc with anterior part light tan, centrally maroon to brown, posteriorly light tan; ventrally clothed in delicate rose scales and hairs; tarsi black, white banded apically; primaries with basal half line geminate, basally dark brown, apically light olive; basal dash from base of wing to basal line, inclosed costal part maroon; inner marginal basal area and transverse anterior area confluent, yellow-olive; transverse anterior line geminate, dark, filled with yellow-green; median space maroon; claviform faint, of rust-red scales, outlined in dark brown; orbicular spot somewhat oval, dark outlined with yellow-green inner lining, centrally filled with rust-red scales; reniform mark more prominent than orbicular spot, colored as in orbicular spot but with rust-red more outstanding; transverse posterior line geminate, dark brown, filled with yellow-green; subterminal area deep maroon; subterminal line defined by contrasting of maroon subterminal area with lighter terminal area; terminal area yellow-green, irrorated with brown; terminal line represented by lunules between veins; veins scantily outlined in white (visible under 10X); fringes bicolor, basally pink, terminally brown; ventral surface with rose colored costal area; transverse posterior line represented by black dash protruding inward from costa; terminal area irrorated with white; remainder of wing brown; secondaries dorsally deep

fuscous, lightest basally; fringes bicolor, basally pink, terminally white; ventral surface a delicate rose costally; exterior band brown, remainder of wing fuscous; fringes as in dorsal surface. Abdomen fuscous dorsally with long simple hairs on each segment; terminally of rose colored simple hairs; ventral surface unicolorous, composed of bright rose hairs and scales; greatest expanse of forewing 14 mm to 16 mm. Genitalia as in figs. 68, 108.

Female - As in male except transverse anterior line and transverse posterior line broader; antennae as in male except more setose basally; greatest expanse of forewing 14 mm to 16 mm. Genitalia as in fig. 140.

Material studied - 7 males, 17 females, July through October. CANADA. *British Columbia:* Maple Bay, Vancouver Island. UNITED STATES. *California:* Mendocino. *Oregon:* Benton; Josephine.

Recognition characters - *A. pulchrata* is a very distinct species and can be confused only with *discoidalis*. Specimens of *pulchrata,* however, must be either worn or otherwise damaged to be readily confused with *discoidalis*.

Immature stages - Accompanying the original description of *pulchrata* was the following discussion pertaining to the immature stages "The larva. . .was found. . .crawling up a fence post on May 20th, 1918, evidently looking for a place to pupate. The larva was blackish brown in color, with darker oblique markings on the last 4 or 5 segments. It was supplied. . .with a rotten piece of wood, into which it immediately disappeared, the perfect insect emerging on July 22nd. As the larva probably went into pupation within a day or so of its disappearance, the approximate duration of the pupal stage would be about sixty days." In addition to this information of Blackmore, the author received the following information concerning immature stages of *pulchrata* from McFarland.[1] Larvae accepted *Rubus* sp. for first two instars; one larva attained third instar but no further development was observed. At this late fall date (near Corvallis, Benton County, Oregon) *Rubus* was the most flourishing plant, and thus was tried. It was felt that the failure to rear *pulchrata* to completion was due to the eggs being kept indoors where premature hatching was induced; had they been overwintered under natural conditions the larvae may have hatched and undergone normal development utilizing *Rubus* as a foodplant.

Distribution - It is difficult to define the range of *pulchrata* accurately due to the few specimens available for study. It is apparently confined to the coast ranges from northern California (Mendocino County) northward into British Columbia (see distribution map, fig. 18).

A. pulchrata, as its name reflects, is quite a beautiful species, and is the most spectacularly colored one within the genus. It is very rare, and is represented in few collections.

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[1] McFarland, Noel - per. communication, 1965.

A. apposita Group

Diagnosis - Antennae basally ciliate, apically setose-ciliate, of female nearly same, but fewer setations apically; palpi exterolaterally blackish, third segment with long brown hairs basally; thorax with divided collar; primaries brick red to dark brown; aedeagus of male genitalia possessing a sclerotized spined band, but no cornuti; valves sublanceolate; ampulae prominent; uncus pointed; female genitalia with ovipositor lobes rounded off, not pointed; ductus bursae moderately sclerotized (as in figs. 141, 142); bursa copulatrix possessing two signa; greatest expanse of forewing varies from 12 mm to 16 mm.

Included species - *A. apposita* (Grote), and *nanalis* (Grote).

Distribution - Occurs over the greatest part of western North America from California eastward into Colorado and northward into Canada.

Key to species of the *apposita* group by superficial characters.

1. Primaries brick red to red brown; ordinary transverse cross lines evident; primaries not longitudinally bicolor; secondaries dark fuscous, veins indistinctly outlined in darker brown; greatest expanse of forewing varying from 14 mm to 16 mm. . . .*apposita* (Grote)

   Primaries longitudinally bicolored from base to subterminal line, costally tan, inner marginally dark brown; ordinary transverse cross lines obscured, or wanting for most part, costally represented by dark brown wedges; secondaries light brown, veins conspicuously outlined in dark brown; disc tan, tegulae dark brown; greatest expanse of forewing 11 mm to 14 mm. . . .*nanalis* (Grote)

Key to species of the *A. apposita* group by genitalia.

1. Uncus of male 2/5 length of valve; aedeagus very nearly equal to length of valve; ovipositor lobes of female each appearing to be bilobed; ductus bursae with a broad sclerotized band. . . . . .*apposita* (Grote)

   Uncus of male 1/4 length of valve; aedeagus 3/4 the length of valve; ovipositor lobes of female with each lobe not appearing bilobed; ductus bursae lacking broad sclerotized band (as in fig. 142). . . . . .*nanalis* (Grote)

Abagrotis apposita (Grote)
(figs. 19, 69, 109, 141, 218-220)

Agrotis apposita Grote, 1878, Bull. U.S. Geol. Sur. Terr. 4:170, type female, Vancouver Island, British Columbia (Hy. Edw. No. 5626), (BMNH); 1883, Papilio, 3:78.

Adelphagrotis apposita, J. Smith, 1890, Bull. U.S. Nat. Mus. No. 38, pp. 39, 41-42; 1893, Bull. U.S. Nat. Mus. No. 44, p. 58; Dyar, 1903 (1902), Bull. U.S. Nat. Mus., No. 52, p. 130.

Eurois apposita, Hampson, 1903, Cat. Lepidoptera Phalaenidae Brit. Mus. 4:615, 616-617, pl. 76, fig. 27.

Matuta apposita, Barnes and McDunnough, 1917, Check list Lepidoptera Boreal Amer., p. 48; Draudt, in Seitz, 1923, the Macrolepidoptera of the World 7:80, pl. 12(e), fig. 1.

Abagrotis apposita, McDunnough, 1928, Bull. Canadian Nat. Mus., No. 55, Biol. Ser., No. 16:71; 1938, Mem. So. California Acad. Sci. 1:67; Llewellyn-Jones, 1951, Entomol. Soc. Brit. Columbia, Occasional Paper No. 1, p. 53; Crumb, 1956, U.S.D.A., Tech. Bull. 1135, pp. 115, 121-122.

Diagnosis - Male: Ground color brick red to brown. Head with frons clothed in brown simple and flattened hairs; vertex anteriorly of brown flattened hairs, posteriorly clothed in light tan simple and flattened hairs; palpi with second segment long, clothed in brick red simple and flattened hairs, exterolaterally blackish; third segment stubby, with long brown simple hairs basally, apically light tan; antennae with scape clothed in light tan scales, forming a hood around scape; flagellar segments dorsally clothed in black scales, ventrally finely ciliate, apically setose-ciliate. Thorax with divided collar brown, composed of flattened hairs; anterior tufts prominent, composed of brown flattened white-tipped dentate hairs; tegulae light tan at base of primaries, posteriorly of brown spatulate scales; disc dark brown, with two rust-red porrect posterior tufts; dorsum posteriorly with fine silken light colored hairs; venter with vestiture of brown, light colored tipped hairs; legs with femora and tibiae clothed in light tan pubescence; tarsi with first segment clothed in light tan, second through fifth segments black, apically with a white tan annulus; primaries with ordinary cross lines either prominent or weak; basal half line geminate, when discernible, dark, filled with lighter color; basal area brick red, suffused with brown; transverse anterior area brown, irrorated with brick red scalation; transverse anterior line geminate, with basal portion blending with transverse anterior area, outer line as in inner line, filled with lighter scalation, nearly straight in course but with slight outward bulge medially; median area as in transverse anterior area; orbicular spot and reniform mark hardly discernible, faintly outlined in light tan, centrally of ground color; transverse posterior line geminate, lines of ground color, centrally filled with light tan; subterminal space dark brown, subterminal line thin defined in light tan; terminal area lighter than subterminal area; terminal line represented by lunules on veins; fringes fuscous; ventral surface with costal band of light tan from base to subterminal line; reniform mark brown; subterminal line faint, defined by line of demarcation between subterminal and terminal areas; inner margin with whitish band; remainder of wing dark brown; veins outlined in brown, or not if wing is very dark; fringes tricolor, basally light tan, medially dark brown, apically white; ventral surface tan, irrorated with dark brown scales, lightest basally; discal dot prominent, dark brown; exterior line prominent, dark brown; fringes as in dorsal surface. Abdomen dorsally clothed in

light brown, fifth, sixth and seventh segments with apical whitish annulus; terminal simple hairs bicolor, basally brick red, terminally white; venter clothed in light tan, irrorated with dark brown; greatest expanse of forewing 14 mm to 16 mm. Genitalia as in figs. 69, 109.

Female - As in male, but with more brick red on forewings both dorsally and ventrally; antennae with fewer setations apically; greatest expanse of forewing 15 mm to 17 mm. Genitalia as in fig. 141.

Material studied - 149 males, 97 females, June through October. CANADA. *British Columbia:* Ainsworth; Arrowhead Lake; Creston; Duncans, Vancouver Island; Hope; Kaslo; Vernon; Wellington; Westminster. UNITED STATES. *California:* Calaveras; Lake; Mariposa; Modoc; Placer; Plumas; Siskiyou. *Idaho:* Blaine; Shoshone. *Oregon:* Deschutes; Grant; Jackson; Wallowa. *Washington:* Kittitas; Klickitat.

Recognition characters - *A. apposita* is a very distinct species and superficially can be confused with no other species in the genus. It is characterized by its brick red to brown coloration; ordinary transverse lines evident, or if not, specimen will be bright brick red with slight ochreous cast; secondaries are dark fuscous dorsally. Genitalically it can be confused only with *nanalis,* but *apposita* has much larger genitalia in both sexes than does *nanalis;* the uncus - valve length ratio is 2/5, whereas in *nanalis* it is only 1/4; aedeagus-valve length ratio is 1 : 1, whereas in *nanalis* it is 3/4 : 1. In the female genitalia, *apposita* can immediately be distinguished from other members of the genus by the bilobed appearance (see fig. 141) of each ovipositor lobe.

Distribution - This species is widespread over northwestern United States and into adjacent Canada. It has been collected in central California, northeastward into Idaho, thence north into British Columbia, Canada. Crumb (1956) reared a single larva of *apposita* collected from near Ellensburg, Washington, and he cited serviceberry (*Amelanchier* sp.) as the larval foodplant. For the larval coloration, he stated "Coloration made up of a blackish reticulation on a brown ground."

A. apposita occurs in wooded areas where the larval foodplant occurs, and has been collected at elevations varying from a few hundred feet, to over 7,000 feet elevation.

Abagrotis nanalis (Grote)

(figs. 20, 70, 110, 142, 221-223)

Agrotis nanalis Grote, 1881, Canad. Ent. 13(6):131, type male (teste Hampson)(?), Nevada (BMNH); J. Smith, 1890, Bull. U.S. Nat. Mus., No. 38, p. 206; 1893, Bull. U.S. Nat. Mus., No. 44, p. 67; Grote, 1895, Abhandl. Naturwissenschaftlichen Verein, Bremen 14(1):64; Dyar, 1903 (1902), Bull. U.S. Nat. Mus., No. 52, p. 133.

Lycophotia nanalis, Hampson, 1903, Cat. Lepidoptera Phalaenidae Brit. Mus. 4:546, 577, pl. 75, fig. 31; Barnes and McDunnough, 1912, Contrib. Lepidoptera North Amer. 1(4):5, pl. 1, fig. 12; 1917, Check list Lepidoptera Boreal Amer., p. 46; Draudt, in Seitz, 1923, the Macrolepidoptera of the World 7:73, pl. 12 (a), fig. 1 (! cites *"analis"*).

Abagrotis nanalis, McDunnough, 1927, Canad. Ent. 59(3):65; 1928, Bull. Canadian Nat. Mus., No. 55, Biol. Ser., No. 16:71; 1938, Mem. So. California Acad. Sci. 1:67; Crumb, 1956, U.S.D.A., Tech Bull. No. 1135, pp. 114, 118-119.

Caradrina mantalini J. Smith, 1894, Trans. Amer. Entomol. Soc. 21:77, pl. 5, fig. 13, lectotype male (nec. female, teste J. Smith), Glenwood Springs, Colorado, September, No. 386, Coll. Bruce, genitalia on slide No. 1796 E. L. Todd, type No. 227 (USNM); Dyar, 1903 (1902), Bull. U.S. Nat. Mus., No. 52, p. 110; Barnes and McDunnough, 1912, Contrib. Lepidoptera North Amer. *(nanalis = mantalini)* 1(4):5.

Diagnosis - Male: Ground color of primaries longitudinally bicolored, tan and dark brown. Head with frons and vertex clothed in unicolorous dark brown or light brown flattened hairs and simple scales; hairs bordering compound eyes light tan; palpi with first segment exterolaterally with dark brown spatulate scales, ventrally with elongate tan simple hairs; second segment dark brown exterolaterally, apically tan; third segment bicolored, basally dark brown, apically tan; antennae with light tan scales surrounding scape; flagellar segments dorsally with row of scales, basally tan, apically dark brown, ventrally ciliate, apically setose-ciliate. Thorax with divided collar porrect, composed of light tan, fawn brown and dark brown spatulate hairs, with purple sheen; disc light tan; tegulae composed of dark brown simple scales, inner margin of black scales; ventrally clothed in light brown; legs with femora and tibiae unicolorous, brown; tarsi brown, tarsomeres weakly banded apically in light tan; primaries with normal cross lines represented on costa in black, geminate, filled with tan; cell, adjacent region from costal margin from base to transverse anterior line tan, remainder of wing darker brown; orbicular spot and reniform mark wanting; transverse posterior line faintly black, geminate, filled with tan; subterminal line represented by contrast between dark brown subterminal area and lighter terminal area; veins outlined in black; terminal line represented by lunules between veins; fringes fuscous; ventral surface light brown, glossy; costal area lighter than remainder of wing; transverse posterior line represented on costa in black; fringes fuscous; secondaries dorsally light brown, veins outlined in dark brown; fringes lighter than remainder of wing; ventral surface tan, lightly irrorated with dark brown; exterior line represented as faint black dash; discal dot faint, dark brown, veins outlined in dark brown; fringes whitish. Abdomen dorsally light brown irrorated with dark brown elongate scales; ventral surface slightly lighter than dorsal surface; greatest expanse of forewing 12 mm to 14 mm. Genitalia as in figs. 70, 110.

Female - As in male except ground color slightly lighter; disc almost whitish in some instances; secondaries somewhat darker; greatest expanse of forewing 11 mm to 14 mm. Genitalia as in fig. 142.

Material studied - 76 males, 51 females, July through October. CANADA. *Alberta:* Lethbridge. UNITED STATES. *California:* Alpine; Inyo; Lassen; Modoc; Mono; Nevada; Placer. *Colorado:* "Colorado" Coll. Bruce; Garfield. *Montana:* Braodwater; Jefferson. *Nevada:* Douglas; Elko. *Oregon:* Baker; Crook; Harney; Malheur. *Utah:* Carbon; Eureka; Jaub; Salt Lake; Sevier; Utah. *Washington:* Yakima.

Recognition characters - Superficially, *nanalis* is distinct from all other members of the genus. It possesses longitudinally bicolor primaries, which are light tan costally, inner marginally dark brown; ordinary cross lines obscured, or wanting; disc tan, tegulae dark brown; greatest expanse of forewing 11 mm to 14 mm. This species is the smallest in the genus. Genitalically, *nanalis* might be confused only with *apposita,* but there is considerable difference in the size of the genitalia between the two species of the group, *nanalis* being the smaller. *A. nanalis* may be distinguished genitalically from *apposita* by: 1) the uncus-valve ratio of the male being 1/4, whereas *apposita* is 2/5; 2) aedeagus-valve ratio being 3/4:1, whereas *apposita* is 1:1; 3) ovipositor lobes of female simple, not appearing bilobed as in *apposita;* and 4) bursae lacking broad sclerotized band.

Immature stages - Crumb (1956) reared many larvae of *nanalis* in eastern Washington, and stated that the: "Larvae begin to become mature about the middle of May and are present to at least the first of June." Moths have emerged in August, and he cited the larvae as feeding ". . . exclusively on sagebrush *(Artemisia).*"

Distribution - This species, as for *apposita,* is widely distributed in northwestern United States and into adjacent Canada. As indicated in the "immature stages" section, this species is restricted to sagebrush, and probably occurs over much the same range (see distribution map, fig. 20) as does its larval foodplant.